Published in final edited form as:

Am J Health Behav. 2018 September 01; 42(5): 54–64. doi:10.5993/AJHB.42.5.5.

Using an e-Cigarette is Like Eating Tofu When You Really Want Meat

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Abstract

Objectives: Whereas controversy about the e-cigarette's effectiveness and safety as a smoking cessation tool continues, e-cigarette use prevalence continues rising. In this study, we sought to describe experiences of adult e-cigarette users and to examine their motivations, beliefs, and use patterns.

Methods: This qualitative study included one-on-one semi-structured phone interviews with 20 current California e-cigarette users (mean age = 38 ± 9.44 years). Interviews were transcribed and thematically analyzed using MAXQDA.

Results: E-cigarettes initially addressed participants' problems related to smoking; they no longer smelled like cigarette smoke and could avoid smoke-free regulations. Participants highlighted the importance of e-cigarette flavors and of "receiving moral credit" for harm reduction by using e-cigarettes to quit smoking cigarettes. Many described eventual dissatisfaction with e-cigarettes, which resulted in relapse to cigarette smoking and/or dual use with cigarettes. The convenience of e-cigarettes coupled with the pattern of constant use left participants increasingly reliant on e-cigarettes.

Conclusions: Ultimately, failed cessation and dual use exposes smokers to greater levels of nicotine, while still exposing them to cigarette smoke. Public health campaigns should promote awareness of the risks of using e-cigarettes, including failed cessation attempts, dual use, addiction, and other health consequences.

Keywords

e-cigarettes; dual use; addiction; e-cigarette flavors; smoking cessation

The use of electronic cigarettes (e-cigarettes) has become ubiquitous, due in large part to extensive tobacco industry marketing of them as a safe alternative to smoking conventional cigarettes and as an effective tool for smoking cessation. An e-cigarette contains a liquid

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Human Subjects Statement

The present study was approved by the UCSF IRB (IRB #: 15-17069).

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

(with or without nicotine) to be vaporized and inhaled. There are several types (generations) of e-cigarettes with common components: aerosol generator (ie, atomizer, heating element); flow sensor; battery; and a cartridge containing an e-liquid (ie, solution with propylene glycol and/or vegetable glycerin, flavorants, and nicotine).^{1,2}

The global e-cigarette market has exploded and is predicted to achieve a total market value of \$50 billion by 2025.³ In the United States (US), from 2011 to 2014, marketing expenditures for e-cigarettes made over a 10-fold leap from \$12 to \$125 million.^{4,5} Adult ever and current use of e-cigarettes is rising rapidly, and the prevalence is highest among recent former and current smokers.⁶⁻⁹ The 2014 National Health Interview Survey (NHIS) established that 22% of recent former cigarette smokers (quit < 12 months ago), 2.3% of long-term former smokers (quit >12 months ago), and only 0.4% of never-smokers currently used e-cigarettes.⁸ In the 2013-2014 Population Assessment of Tobacco and Health (PATH) Study, most e-cigarette users reported less than daily use. Among the adult current e-cigarette users, there were 42.2% infrequent users, 36.5% moderate users, and 21.3% daily users; compared to current cigarette smokers, those who quit smoking in the past year were more likely to report daily e-cigarette use (adjusted prevalence ratio = 3.21, 95% CI = 2.75, 3.76).¹⁰ In addition, Delnevo et al⁹ found that compared with daily cigarette smokers, those who had quit smoking for less than a year were 4 times as likely to be daily e-cigarette users.

Among scientists, there is controversy about the effectiveness and safety of e-cigarettes.¹¹ Proponents of e-cigarette use assert that they are substantially less harmful than cigarettes and are an effective way to stop smoking. They promote e-cigarettes as having the potential to replace combusted cigarettes and save lives more rapidly than current tobacco control efforts.¹² A systematic review of 57 research studies and 5 previous systematic reviews reported a positive association between smoking cessation and e-cigarette use.¹³ However, there is substantial evidence that e-cigarette use is not associated with an increase in smoking cessation rates, but instead, is associated with an overall reduction in successful smoking cessation rates. In one meta-analysis, the odds of successful smoking cessation were reported to be 27% lower among e-cigarette users than those who did not use e-cigarettes.^{14,15} Two factors were found to impact cessation outcomes, use patterns (ie, frequency of use) and e-cigarette type (ie, tank or cig-a-like).¹⁵

Opponents of e-cigarettes agree that e-cigarettes deliver fewer carcinogens than conventional cigarettes. However, there is strong evidence that they expose users to levels of ultrafine particles and toxins that can significantly raise the risk of cardiovascular and lung disease (non-cancer).¹⁵ More than 50% of all deaths related to smoking are caused by these 2 comorbidities.¹⁵ A 2018 systematic review on the safety of e-cigarettes found that levels of heavy metals, volatile organic compounds, and tobacco-specific nitrosamines were higher in e-cigarettes than in conventional cigarettes.¹⁶ Thus, despite the growth of e-cigarettes' popularity and use, many questions remain concerning their effectiveness for cigarette smoking cessation and their impact on health.¹⁵⁻¹⁷

The literature reports that e-cigarette users, based on their own experiences and information available to them from the Internet, marketing messages, and friends and family, they believe the benefits of e-cigarette use include improved health, smoking cessation, therapeutic mood

regulation (ie, feeling euphoric, calm, and relaxed), convenience, the ability to circumvent no smoking policies, and reduced stigma when compared to cigarette smoking.^{10,18-21} There are a number of anecdotal accounts from current smokers who report that e-cigarettes supported their cessation attempts and from former smokers who assert that e-cigarettes helped them reduce withdrawal symptoms and avoid relapse.^{19,21} In contrast, there is mounting evidence that for smokers and former smokers that e-cigarette use leads to dual use and relapse.^{22,23} Research has shown that the likelihood of conventional cigarette cessation and dual use depends on the length of time using e-cigarettes, intensity of e-cigarette use, and expectancies related to e-cigarette use.²⁴⁻²⁶

As the prevalence of e-cigarette use increases and controversy about their effectiveness and safety continues, long-term *in vivo* studies are needed.^{6,8,15-17,27} To inform these long-term studies, research is needed to examine the lived experience of smokers who use e-cigarettes. Three previous studies have investigated similar topics, but in these studies, participants generated and sorted statements related to various e-cigarette prompts, which were then aggregated and grouped into clusters via concept mapping.^{18,28,29} In contrast, the present study utilized one-on-one interviews, which enabled researchers to engage participants in conversations and obtain rich narrative data. Interviews assist in understanding new and emerging behaviors and in collecting detailed, comprehensive information from actual e-cigarette users. As such, the purpose of this study was to explore the beliefs (related to health, social norms, etc), motivations (ie, reasons to initiate, continue, and/or stop e-cigarette use), use patterns (ie, frequency and intensity of e-cigarette use), and experiences of adult e-cigarette users.

METHODS

To achieve the goals of this research, we conducted a qualitative study that included one-on-one semi-structured phone interviews with 20 current California e-cigarette users.

Recruitment and Data Collection

This study was part of a larger longitudinal study with adult tobacco users. Participants were recruited through Craigslist, which has been used previously to recruit smokers and found to be cost effective and efficient.^{30,31} The Craigslist posting was online for one month and stated that a research team was looking for paid volunteers for phone interviews for a descriptive study on the experience of e-cigarette users. Qualified participants had to live in California, have used e-cigarettes at least once a week in the past 30 days, be at least 24 years old, and agree to one 45-60-minute phone interview. Compensation for completing the interview was a \$20 gift card. Those interested were asked to directly email a research assistant (RA). The RA returned emails to confirm eligibility. After 3 weeks, 23 responses were received. For those determined eligible, the RA sent an email with a research office phone number and an attached consent form and arranged a date for the interview. Three participants did not follow through. The 45-60-minute, one-on-one semi-structured phone interviews were conducted between October and December 2015. At the start of each call, eligibility criteria were reviewed, the consent form was discussed, and the participant provided verbal consent. The interviews were tape recorded.

During the interview call, participants were reminded that the purpose of the study was to improve understanding of the experiences of adult e-cigarette users and to examine their motivations, beliefs, and use patterns of e-cigarettes and other tobacco products. Because participants differed widely in their style and way of responding to interview topics, each interview was slightly different in structure. However, the interviewer was guided by a set of topics (participants' past, present, and anticipated use of e-cigarettes and other tobacco products; use of flavors and nicotine in these products; and views/beliefs about the acceptability of these products), and if participants did not offer information on a particular topic, they were asked a more pointed question. The interviews began with general questions about e-cigarette and other tobacco product use. The participant was asked to clarify and elaborate on various comments (eg, "Can you say more about that?" "Why did you make that choice?" or simply, "How would you describe your experience?"). Sufficient time and encouragement was given by the interviewer to allow each participant to relate their story, which allowed for each participant to be spontaneous in discussing the material they found most important.

Data Analysis

All interview recordings were transcribed and imported into MAXQDA, software that allows for organization, analysis, and visualization of interview data. MAXQDA enables researchers to create hierarchies of codes (codes and sub-codes) while reading transcripts. All interviews were read several times by a primary analyst experienced in qualitative analysis. Themes and codes were identified inductively from the interview guide and data analysis. As analysis progressed, the primary analyst refined codes and applied them to segments of each transcript. Results were supplemented by a second member of the research team who read each transcript to ensure consistency and relevance of the identified themes. The 2 researchers were consistent in their interpretation of the data, and the second member of the research team supplemented the primary analyst's work by pulling additional relevant quotations from transcripts to support identified themes and by calculating descriptive summary data about the participants' conventional cigarette and e-cigarette use (using SPSS version 24).

RESULTS

Phone interviews were conducted with 20 regular e-cigarette users who lived in California, ranged from 25 to 60 years old ($\bar{x}$ = 38 years, SD = 9.44), 55% female (N = 11), and 60% employed (N = 12). Participants had been using e-cigarettes on average for 19.00 months (SD = 8.52 months; range: 10-36 months); and in the last 30 days, participants had an average e-cigarette use of 24.80 days (SD = 8.42 days; range: 6-30 days). Eight participants currently smoked conventional cigarettes (dual users with e-cigarettes), and 12 previously smoked conventional cigarettes. Only 3 participants used e-liquid without nicotine, one of whom used medical marijuana in a vape pen.

From this sample, 5 themes related to e-cigarettes emerged (summarized in Table 1): (1) reasons for initiation and benefits of use (ie, belief that e-cigarettes will help with reduction and/or cessation of cigarette smoking, pleasant smell of e-cigarettes, increased social

acceptability, convenience, belief that e-cigarettes are healthier than cigarettes); (2) large role of flavors (ie, greater preference for flavors among women, ability of flavors to satisfy food cravings, worry about chemicals within flavored e-liquid); (3) lack of satisfaction leads to dual use (ie, e-cigarettes' inability to satisfy users as much as cigarettes results in use of both products); (4) dissatisfaction and smoking relapse (ie, belief that e-cigarette use is not harmless, e-cigarettes serve as a gateway to relapse to cigarette smoking, stigmatization of e-cigarette use); and (5) convenience leads to increased nicotine exposure and addiction (ie, ability to use e-cigarettes anywhere enables nonstop vaping and increased frequency of e-cigarette use leads to the use of more powerful devices that provide more nicotine).

Reasons for e-Cigarette Initiation and Benefits of Use

For most participants, initiation of e-cigarette use was related to a partner, family member, or friend. The most common reason for initiation and use was to reduce or quit smoking conventional cigarettes:

"I was at a higher nicotine level, but I'm gradually moving my nicotine level down and cutting more cigarettes out of my daily habit."

Most identified the pleasant smell of e-cigarettes and the absence of a residual cigarette smoke smell as an important advantage:

"I know that you don't smell. You don't stink ... Being in the second-hand smoke of vape smells good. It's enjoyable unlike sitting in second-hand smoke of a cigarette that is annoying and - and repulsive."

Another benefit was initial cost savings, because disposable e-cigarettes are generally less expensive than conventional cigarettes. However, a few explained that e-cigarette use becomes more expensive after switching to a non-disposable device to modulate nicotine levels. But, a benefit for many was the ability to modify the product to adjust to smoking style and level of nicotine:

"I can control the amount of nicotine that goes in that I can gradually cut down the nicotine."

Some participants liked the aesthetics of vaping devices. Several stated that using e-cigarettes makes them feel cool and pointed out that e-cigarette use is more acceptable than smoking conventional cigarettes:

"Vaping is almost more politically correct if you will – cooler... It just seems to be more socially accepted."

"You know, it's fun. You know, and it's just like – I think - I think it's cool."

Additional advantages of e-cigarettes were the convenience of smoking everywhere, including designated no-smoking areas:

"And, it's easier because you can do it in your house. You can do it in someone else's house, whatever, yeah. And, you can do it in someone's car. And, you could do it in a taxi, you know? Or a bus. Can't smoke on a bus. You could sneak one on an airplane. You're not supposed to, but you could. You can't sneak a cigarette anywhere, you know what I mean?"

“Instead of taking all that time because it takes 5 or 6 or 10 minutes to smoke a cigarette, I can just take a couple puffs off of the vape, and it appeases me to where I don’t have to do it for a while. And, I get more things done. I have more time during the day rather than constantly having to, you know, go somewhere and smoke for 10 minutes and, you know, be gone for that considerable period of time”

Most participants asserted that a substantial benefit is that e-cigarettes are healthier than conventional cigarettes, and some maintained that e-cigarette vapor is the same as water vapor:

“...I mean, on foggy days, we breathe vapor. You know, if you live by the coast, you’re breathing in vapor, you know. So, I think if it’s a flavored water, I don’t see where it could really hurt you.”

In contrast, a few participants noted that the health effects of e-cigarette use are yet unknown:

“...it can’t be just completely harmless...So, I think it’s, like, the long-term effect I’m kind of concerned about.”

Many reported feeling better after switching to e-cigarette use:

“When I was smoking, I was out of breath quite often. And, it’s not like that anymore at all. I don’t have to breathe these [conventional cigarettes] all day and all that gnarly stuff Nope. Not anymore.”

Role of Flavors

Flavors were described as both a benefit and detriment. Many, especially women, preferred flavored e-cigarettes. When asked how important flavors were, one woman responded:

“I think it’s really important. It’s just, like, you know, just like when you eat something you want it to, you know, taste good. So, same thing with smoking. Like, you, you know, you’re tasting the flavor. So, it’s like, one out of ten, it’s, like, a ten. It’s really important.”

Some women explained that e-cigarettes help to satisfy food cravings; 2 maintained that their e-cigarette use helped them avoid weight gain:

“I used the vape pen, not so much now for smoking, but for, like, curbing my appetite. Like, when I want a snack, like, if I want to eat candy or junk or something ...I’ll go vape.”

“...instead of picking up a candy bar or eating ice cream or something like that, I’m accomplishing it by vaping instead.”

However, a few participants preferred e-cigarettes without flavors, and some expressed reservations about the possible chemicals in flavors:

“The flavors, right now, some of them do actually contain some really bad chemicals that shouldn’t be inhaled, and they’re sold, and they don’t have to disclose that when they sell them. And, people are doing their own testing and figuring out which ones have and warning others to stay away, but that’s not good

enough. Certain flavors shouldn't be on the market if they're as hazardous as they claim."

Lack of Satisfaction Leads to Dual Use

Although the most common reason for e-cigarette use was for cigarette smoking reduction or cessation, reported success was mixed, and the result was often dual use of cigarettes and e-cigarettes. Participants expressed that their hope for an e-cigarette that could satisfy them as much as a cigarette or cigar was unfulfilled:

"Basically, if I find a vaporizer that makes me feel like I'm actually smoking a cigarette or a cigar, I would quit everything else. I would quit cigars. I would quit regular cigarettes. And, then I would slowly drop my nicotine level down from the vaporizer."

Participants described casual e-cigarette use when they were not feeling stressed:

"But if I just want to, you know, just do some relaxation, like sometimes it just helps me think, I just e-vape. Or, I just want to, you know, taste the flavor and stuff like that. Or, sometimes if you... just got done smoking a cigarette, you can e-vape to cover up the smell with pineapple or something like that."

However, several reported that when having cravings for nicotine or when stressed out, they were more likely to smoke a conventional cigarette:

"So, if I got a craving, I'm just going to go for the cigarette mostly..."

"...When I'm stressed, I'm going to smoke a cigarette. And, too, it's as if the cigarettes kind of make you feel more fulfilled. An e-cigarette is like eating tofu [when] alls [sic] you [want to] do is eat meat."

e-Cigarettes, Dissatisfaction, and Smoking Relapse

Whereas many participants believed e-cigarettes are a healthier alternative to conventional cigarettes, a few noted health concerns. e-Cigarette use is not harmless:

"One of my friends says it's like getting shot with a lower caliber bullet, you know? ... It's like, oh, you're not getting shot with a .45. You're only getting shot with like a little .22, but you're still getting shot, you know?"

"The one thing I do notice when I smoke [e-cigarettes] is that my throat gets kind of scratchy. Like, it gets sore sometimes if I do it too much."

For some, e-cigarette device failure was a reason for relapse to conventional cigarettes. A few participants complained that e-cigarettes are too complex and ultimately unreliable, reporting leaking devices and other problems:

"...it's like they made them to not work good anymore. – just like anything else in America, you know. When they come out with something and they get you to like it, and they, you know, start making it garbage, so you have to buy the big, elaborate ones. And so, I mean, I'm just not into getting ripped off..."

Some believed that e-cigarette use can precipitate smoking relapse. For one participant, e-cigarette use represented a gateway to reinitiate smoking cigarettes after having successfully quit:

“... I hadn’t been smoking for quite a while, and I just got this urge...I bought that disposable vaper thing because I didn’t want to buy a pack – because I wasn’t smoking. And, I was having this really strong urge, and I just walked into this 7/11, and bought one of those things, and smoked them. So, then I felt guilty because I had quit smoking, and here I am, smoking. So, I threw it in the trashcan. But the next day, I think, I bought a pack of cigarettes.”

Whereas many reported that family and friends were more likely to approve of e-cigarette use than of conventional cigarette smoking, some said they still felt stigmatized. One participant expected positive reinforcement for switching to e-cigarettes; when this reinforcement was not forthcoming, motivation to continue with cigarette cessation dissipated:

“...[e-cigarettes] helped me at first. They – I totally quit smoking. The peach flavor was the flavor that I liked, and it seemed like it was stronger, and it really curbed my craving for a cigarette. And, then I felt I was going to be able to just give that up, but instead, I just started smoking out of spite. I’m stupid, because nobody was proud of me or whatever, and I just started smoking.”

e-Cigarette Convenience Leads to Increased Nicotine Exposure and Increased Addiction

Because e-cigarettes were used to avoid no-smoking restrictions, participants reported that they engaged in constant vaping:

“I think I vape more than I used to smoke. Reason being vaping is more socially acceptable... I vape – I wake up in the middle of the night, it’s 4 in the morning and I go right to the nicotine. Whereas [with] cigarettes, I believe I would have to go outside. Yeah, so my vaping is all the time, pretty much nonstop.”

“I couldn’t really smoke at work. So, I didn’t smoke when I was at work, except for once or twice. And, like, a little later, after I wake up, I would smoke, compared to, like, if I vape. I can, like, literally just open my eyes and reach over for it. I mean, and the same with, like, going to sleep. Occasionally, I even do it in the middle of the night, when I never got up to smoke a cigarette when I was asleep...It’s just a lot more convenient. It’s almost more addicting.”

To support frequent vaping, several participants reported that they kept multiple vaping devices ready to be used in case of device failure or loss:

“I just use this one. It just could cover everything. So, the other ones I just have as backup, I suppose.”

With increased frequency of use, some graduated to more powerful devices that could provide more nicotine per draw. If participants reduced the percentage of nicotine in their e-liquid, they compensated by vaping more intensely. One participant described nicotine as a poison:

“...For a while, I was really thinking that it was so much better than smoking and that they were even saying that nicotine, it is addictive, but it’s not that horrible. And, I let myself believe that...I actually really, truly know that nicotine is a horrible, toxic – super toxic chemical that we’re adding to my bodies [sic]. It’s like a poison and it constricts your blood flow, it makes my hands cold. I always have had cold, cold hands.”

This same participant initially saw e-cigarettes as a panacea, because she was able to stop smoking and feel healthier. However, after almost 3 years of using e-cigarettes, she became disillusioned and realized she simply replaced one addiction for another:

“At the very beginning, for me, the e-vape was an absolute joy and wonderful thing. And, it is because it has freed me from tobacco, the actual smoke, the actual coughing, the actual smelling of all the cigarettes... Two and a half years, almost 3 years later on the vaping, though, I’m a very addicted person so I’m starting to hate the e-vape. And, the reason is because I am so addicted to the nicotine that I have a hatred for it.”

DISCUSSION

Reasons for e-Cigarette Initiation and Benefits of Use

Similar to findings from previous studies, in our study, most participants initiated e-cigarette use to quit smoking conventional cigarettes.^{19-21,25} Commonly reported benefits of e-cigarette use included convenience of e-cigarette use, perceived ability to aid cessation, and pleasant smell of e-cigarette vapor, which covers cigarette smoke odor. Additionally, compared to conventional cigarettes, e-cigarettes are often perceived as less harmful to health, less expensive (at least initially), and more socially acceptable. Our findings support previous studies that found e-cigarette users’ beliefs about the benefits of e-cigarettes clearly reflect exposure to tobacco industry marketing messages that highlight the ability to avoid smoke-free policies and positive lifestyle factors.^{5,18,20,21,32} These messages ultimately promote dual use and could harm cessation efforts.³² With the growth in e-cigarette marketing and increased use of social media platforms, these messages are reaching more segments of the US population.^{4,5}

Similar to findings of previous studies, participants in our study reported dissatisfaction with e-cigarette device failure, unknown and known negative health effects for themselves and those close to them, and addictiveness.^{19,20,29} Although many participants expressed a lack of satisfaction with e-cigarettes, they did not discontinue use, and some even increased concentrations of nicotine in their e-liquid and/or vaped longer and more often. Continued use is likely due to participants’ perceived benefits of, and addiction to e-cigarettes.

Some e-cigarette users experience reduced stigma when they use e-cigarettes instead of smoking conventional cigarettes,¹⁸ yet others continue to experience stigma related to e-cigarette use because of the product’s association with cigarette smoking.²⁹ Our findings capture both sides of this story and indicate that e-cigarette users often want “moral credit” for harm-reduction efforts. If such approval for their efforts is not forthcoming, users could

relapse to smoking cigarettes. Ultimately, e-cigarette use stigmatization may negatively affect cessation efforts.

Role of Flavors

Our results suggest the importance of flavors in e-cigarette use, which prior studies have also high-lighted.^{18,20,23,28} Most participants used and enjoyed flavored products due to their pleasant taste/smell and the fact that the vapor covers any smell of cigarette smoke. We also found a flavor-related sex difference, with more women endorsing flavored e-liquid. This dissimilarity aligns with previous research showing that flavors are more important to women than to men,³³ as well as that men prefer tobacco flavors but women prefer sweet flavors.³⁴ These results indicate that regulating flavored e-liquid may disproportionately affect women, and result in greater reduction in use for women.

In addition, our findings support previous reports that e-cigarettes enable users to enjoy different tastes without consuming calories and that females more commonly endorse e-cigarette use for weight control.^{28,35,36} Sex differences behind reasons for e-cigarette use indicate that public health messages can be tailored by sex to achieve maximum impact.

Lack of Satisfaction Leads to Dual Use, Relapse, and Addiction

Most found e-cigarettes to be less satisfying than conventional cigarettes, which led to increased cravings, constant vaping, and increased dual use. These findings support previous studies that found e-cigarette users: (1) were not as satisfied with e-cigarettes as they were with conventional cigarettes; and (2) experienced increased symptoms of nicotine addiction.²⁹ Furthermore, our results parallel prior longitudinal work demonstrating that when experienced e-cigarette users reduce the nicotine levels in their e-liquid, they consume higher amounts of e-liquid to keep nicotine levels stable in their body.³⁷ Additionally, many described addictive behavior related to frequent e-cigarette use: feeling reliant on vaping, vaping in the middle of the night, and keeping multiple e-cigarettes in the event of device loss or failure. By engaging in this non-stop vaping, many participants increased their nicotine tolerance and dependence.

Numerous studies have demonstrated that e-cigarettes have the potential to re-normalize tobacco use.^{6,7,21,23,38,39} Exposure to e-cigarettes and e-cigarette advertisements make the product seem pervasive and can increase individuals' desires for both e-cigarettes and conventional cigarettes.^{21,40} Such re-normalization is especially problematic due to the tendency of individuals to engage in dual use.^{6,17,23,27} The tobacco industry's promise that e-cigarettes are an effective method of smoking cessation is often not a reality.^{5,32} Instead, e-cigarette use for cessation purposes often results in dual use, subjecting smokers to increased exposure to nicotine and harm. Nicotine use is associated with numerous health consequences, including acute cardiovascular effects; increased risk for cardiovascular, respiratory, and gastrointestinal disorders; and reduced immune response.⁴¹ Additionally, using e-cigarettes to reduce the number of cigarettes smoked per day likely has a far lower beneficial impact on survival than full cigarette cessation would have, partly due to the non-linear dose-response association between cardiovascular disease risk and fine particle exposure.¹⁷ Even those who smoke fewer than one or between one to 10 cigarettes per day

during their life have higher mortality risks than never smokers.⁴² Dual use is a pressing public health concern that must be addressed as e-cigarette use rises. Practitioners and media campaigns need to emphasize the dangers associated with dual use and should convey the separate risks associated with e-cigarette use so individuals can make informed decisions about their use of e-cigarettes.

Limitations and Strengths

The limitations of this study are intrinsic to qualitative methods. The study was designed to obtain narrative data from actual e-cigarette users, and while that is important for informing future research and policy, it is unknown if the identified themes are relevant to all e-cigarette users. Due to the study design, small sample size, and geographical constraint to only individuals residing in California, the results are not generalizable. Furthermore, the cross-sectional nature of the study precludes causal claims regarding e-cigarette use. An additional limitation arises in that a few years have passed since the interviews took place, during which time e-cigarette use and regulation have evolved. However, this study has substantial strengths. Through in-depth one-on-one interviews, we obtained rich data from 20 current e-cigarette users about their use patterns and opinions of e-cigarettes. We reported on similar concept mapping studies,^{18,28,29} but the semi-structured format of our interviews allowed participants to elaborate on their statements so that we could obtain more in depth comprehensive information. These data can inform future long-term *in vivo* studies on the effectiveness and safety of e-cigarettes. This study also uncovered novel paradoxes, such as: (1) how some e-cigarette users reduce the nicotine content of their e-liquid, only to become more addicted to nicotine; and (2) how e-cigarette users often feel their e-cigarette use is more acceptable than cigarette smoking while also feeling stigmatized for their e-cigarette use. In addition, it highlighted how the convenience of e-cigarettes often led to dual use of both e-cigarettes and conventional cigarettes, sabotaging cessation efforts and increasing level of addiction.

Future Recommendations

To address the controversy regarding the safety and effectiveness of e-cigarettes, large, multi-site longitudinal, *in vivo* studies of the effectiveness and safety of e-cigarettes are needed. Mixed-method studies can be used to explore real-world situations of smoking cessation with e-cigarettes that include contextual and psycho-biological factors known to impact risk and safety perceptions, which in turn affect tobacco use and cessation behaviors. In addition, longitudinal studies among those attempting smoking cessation with e-cigarettes are needed to determine use and cessation patterns over time. These studies should account for e-cigarette type, duration of e-cigarette use, e-cigarette use frequency, and other such factors to determine what specific aspects of e-cigarettes and use patterns impact cessation results. Furthermore, as some individuals end up using both e-cigarettes and conventional cigarettes, studies should develop and examine the efficacy of messages that convey the risks of dual use. Finally, future studies should investigate the effects of stigmatization of e-cigarette users who are trying to quit smoking cigarettes and to what extent such perceived judgment impacts cessation efforts.

Conclusion

With the rise of e-cigarette marketing and e-cigarette use, further research is needed to understand the experience of adult e-cigarette users, including the full impact of beliefs and perceptions about e-cigarettes on e-cigarette and cigarette use patterns. To counter the power of e-cigarette marketing messages, public health campaigns need to highlight the known negative health and social consequences of e-cigarette use. These findings will inform public health efforts to decrease both smoking and e-cigarette use.

Acknowledgements

Research reported in this publication was supported by grant number 1P50CA180890 from the National Cancer Institute and Food and Drug Administration Center for Tobacco Products for data collection. The content is solely the responsibility of the author and does not necessarily represent the official views of the NIH or the Food and Drug Administration. Moreover, the authors thank Nicolas Sheon for his expertise and role in data analysis.

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Table 1
Themes and Sub-themes Identified from Interviews with e-Cigarette Users (N = 20)

Reasons for Initiation and Benefits of Use
Belief e-cigarettes will help with reduction and/or cessation of cigarette smoking
Pleasant smell of e-cigarettes and/or absence of residual cigarette smoke smell
Initial cost savings
Modifiability of e-cigarettes
Aesthetics of vaping devices and feeling cool
Greater social acceptability in using e-cigarettes than in smoking cigarettes
Convenience of using e-cigarettes anywhere
Belief that e-cigarettes are healthier than cigarettes
Importance of Flavors
Many, especially women, prefer flavored e-cigarettes
Flavors help satisfy food cravings and avoid weight gain
Some worry about inhaling the chemicals in flavored e-liquids
Lack of Satisfaction Leads to Dual Use
E-cigarettes unable to satisfy users as much as cigarettes
Differential use patterns: e-cigarettes when relaxed and cigarettes when stressed
Individuals use both products instead of one
Dissatisfaction and Smoking Relapse
Some had knowledge e-cigarette use is not harmless
E-cigarette device failure sometimes yields relapse to smoking
E-cigarette use for some is gateway to begin smoking cigarettes again
Some experience stigmatization for e-cigarette use
Convenience Leads to Increased Nicotine Exposure and Addiction
Ability to use e-cigarette anywhere results in constant vaping
Some keep multiple e-cigarette devices in case of device failure or loss
Increased frequency of e-cigarette use results in switching to more powerful devices with increased nicotine per draw